

WHAT IS CLAIMED IS:

1. A swing measurement method for measuring a swing behavior during a swing with an impact implement grasped on a grip portion thereof, comprising the steps of:

fixing a three dimensional magnetic sensor to the grip portion of the impact implement;

forming magnetic fields, each distribution of intensity and direction thereof being known, within a range of motion of the grip portion, so that the three dimensional magnetic sensor senses magnetism of each of the formed magnetic fields for outputting signals corresponding to three dimensional position of the grip portion with respect to a predetermined point, and to pointing direction of the grip portion with respect to a predetermined direction; and

acquiring at least one of three dimensional position coordinates data of the grip portion and pointing direction data of the grip portion from the output signals.

2. The swing measurement method according to claim 1, wherein:

the impact implement is a golf club; and

the three dimensional position coordinates data and the pointing direction data, are acquired during the swing

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of the golf club.

3. The swing measurement method according to claim 2,
wherein the three dimensional position coordinates data
and the pointing direction data, represent the swing
behavior of the grip portion at least from a top state to
an impact state of the swing.

4. The swing measurement method according to claim 2,
wherein:

the three dimensional magnetic sensor fixed to the
grip portion has three mutually orthogonal axes for
sensing;

one direction of an axis from among the three
mutually orthogonal axes being aligned with a direction of
an axis of a shaft of the golf club; and

one direction of an axis from among the other two
axes being aligned with an impact direction of the golf
club.

5. The swing measurement method according to claim 2,
wherein the three dimensional magnetic sensor is fixed to
the end of the grip portion.

6. A golf swing analysis method for analyzing a swing behavior of a golf club, comprising the steps of:

receiving time sequence data of three dimensional position coordinates of a grip portion of the golf club, and time sequence data of pointing direction of the grip portion during a golf swing from a data acquisition means;

calculating a swing plane, on which a swing path of the grip portion is approximated, from the time sequence data of the three dimensional position coordinates;

projecting the swing path of the grip portion on the swing plane and approximating the projected swing path as an arc to obtain the arc as a swing path arc of the grip portion; and

obtaining:

arm angle time sequence data of an arm angle showing a position of the grip portion on the swing plane from the time sequence data of three dimensional position coordinates and the swing path arc; and

at least one time sequence data from the group consisting of:

wrist angle time sequence data of a wrist angle found based on a shaft direction angle obtained from the pointing direction of the grip portion and showing a shaft direction of the golf club on the swing plane, and

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rotation angle time sequence data of a shaft rotation angle, around a shaft axis of the golf club, from the pointing direction.

7. The golf swing analysis method according to claim 6, wherein the wrist angle is found by subtracting the arm angle from the shaft direction angle.

8. The golf swing analysis method according to claim 6, wherein the swing plane of the grip portion is calculated using the swing path of the grip portion including the swing behavior at least from a top state of the golf swing to an impact state.

9. The golf swing analysis method according to claim 6, wherein the swing path arc of the grip portion is calculated using the projected swing path including the swing behavior at least from a top state of the golf swing to an impact state.

10. The golf swing analysis method according to claim 6, wherein the arm angle time sequence data, and at least one of the wrist angle time sequence data and the rotation angle time sequence data, represent the swing.

behavior at least from a top state of the golf swing to an impact state.

11. The golf swing analysis method according to claim 6, wherein the swing behavior of the grip portion is analyzed by plotting at least one time sequence data, from among the wrist angle time sequence data and the rotation angle time sequence data, against the arm angle time sequence data.

12. The golf swing analysis method according to claim 6, wherein:

the data acquisition means, which has a three dimensional magnetic sensor and a means for forming magnetic fields, each distribution of intensity and direction thereof being known, so that the three dimensional magnetic sensor senses magnetism of each of the formed magnetic fields for outputting signals corresponding to three dimensional position of the three dimensional magnetic sensor with respect to a predetermined point, and to pointing direction of the three dimensional magnetic sensor with respect to a predetermined direction,
acquires the time sequence data of the three

dimensional position coordinates and the time sequence data of the pointing direction, by fixing the three dimensional magnetic sensor to the grip portion and forming the magnetic fields within a range of motion of the grip portion during the golf swing.

13. The golf swing analysis method according to claim 6, wherein:

the data acquisition means uses at least one camera from the group consisting of a high speed camera, a CCD camera, and a strobe photography camera; and

the time sequence data of the three dimensional position coordinates and the time sequence data of the pointing direction during the golf swing, are acquired by performing measurements from images obtained by the camera.

14. A computer program product, comprising a computer readable medium having computer program code embodied for an analysis of swing behavior of a golf club,

the computer program code including:

computer program code configured to cause a computer to receive time sequence data of three dimensional position coordinates of a grip portion of the golf club and time sequence data of pointing direction of the grip

portion during a golf swing from a data acquisition means; computer program code configured to cause a computer to compute a swing plane, on which a swing path of the grip portion is approximated, from the time sequence data of the three dimensional position coordinates;

computer program code configured to cause a computer to project the swing path of the grip portion on the swing plane and approximate the projected swing path as an arc to obtain the arc as a swing path arc of the grip portion; and

computer program code configured to cause a computer to obtain:

arm angle time sequence data of an arm angle showing a position of the grip portion on the swing plane from the time sequence data of the three dimensional position data and the swing path arc; and

at least one time sequence data from the group consisting of:

wrist angle time sequence data of an wrist angle found based on a shaft direction angle obtained from the time sequence data of the pointing direction and showing a shaft direction of the golf club on the swing plane, and

rotation angle time sequence data of a shaft rotation angle, around a shaft axis of the golf club, from

the pointing direction.

15. The computer program product according to claim 14, wherein the wrist angle is found by subtracting the arm angle from the shaft direction angle.

16. The computer program product according to claim 14, wherein the swing plane is computed using the swing path of the grip portion including the swing behavior at least from a top state of the golf swing to an impact state.

17. The computer program product according to claim 14, wherein the swing path arc of the grip portion is computed using the projected swing path including the swing behavior at least from a top state of the golf swing to an impact state.

18. The computer program product according to claim 14, wherein the arm angle time sequence data, and at least one of the wrist angle time sequence data and the rotation angle time sequence data, represent the swing behavior at least from a top state of the golf swing to an impact state.

19. The computer program product according to claim
14, wherein the computer program code also includes
computer program code configured to cause a computer to
plot at least one time sequence data, from among the wrist
angle time sequence data and the rotation angle time
sequence data, against the arm angle time sequence data.